Sheet 1 - 2 Sheets.

G. I. Washburn,

Steam-Boiler Water-Feeder,

No. 41,408. Patented Jan. 26, 1864

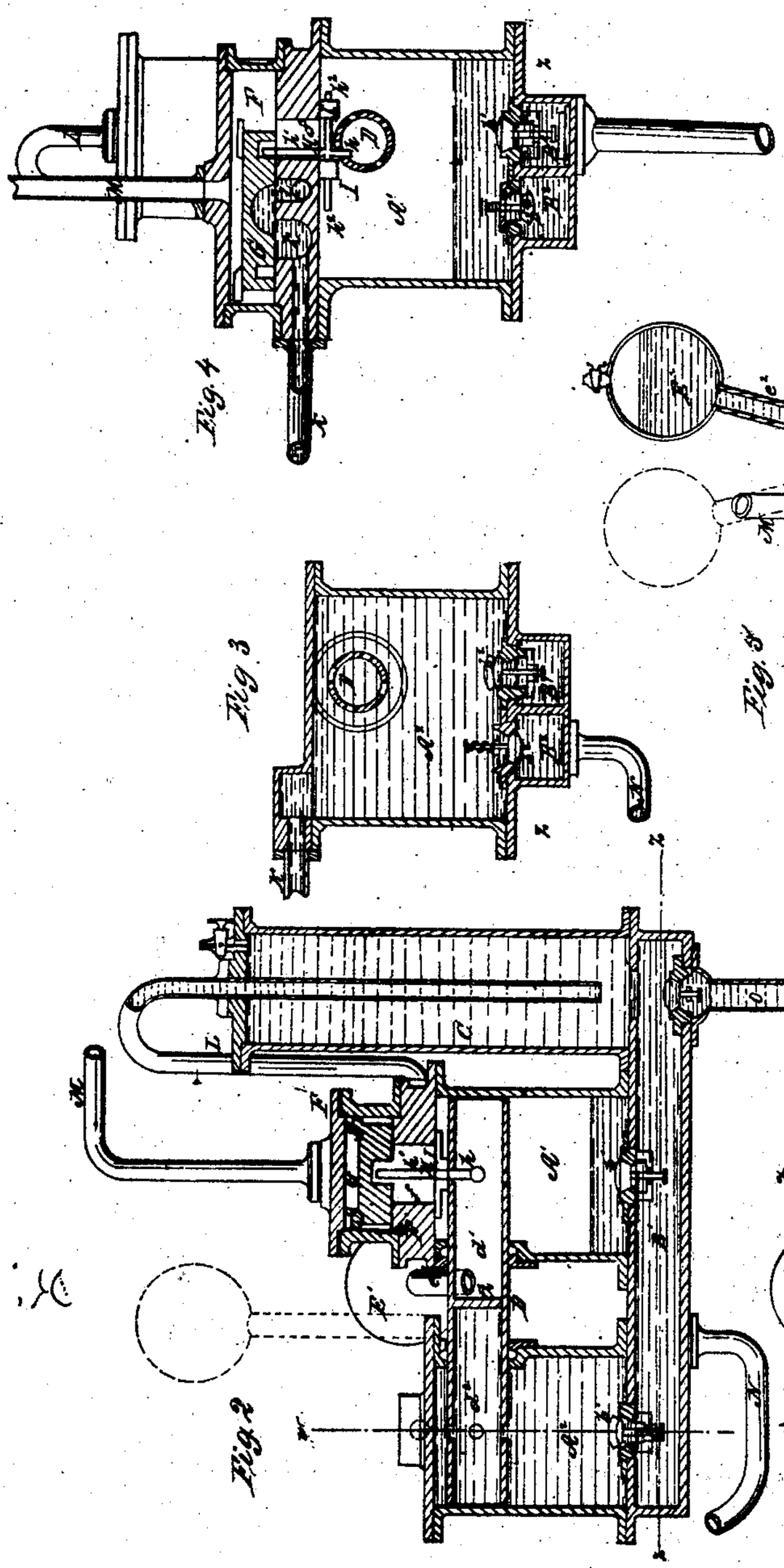

Fig. 4

Fig. 3

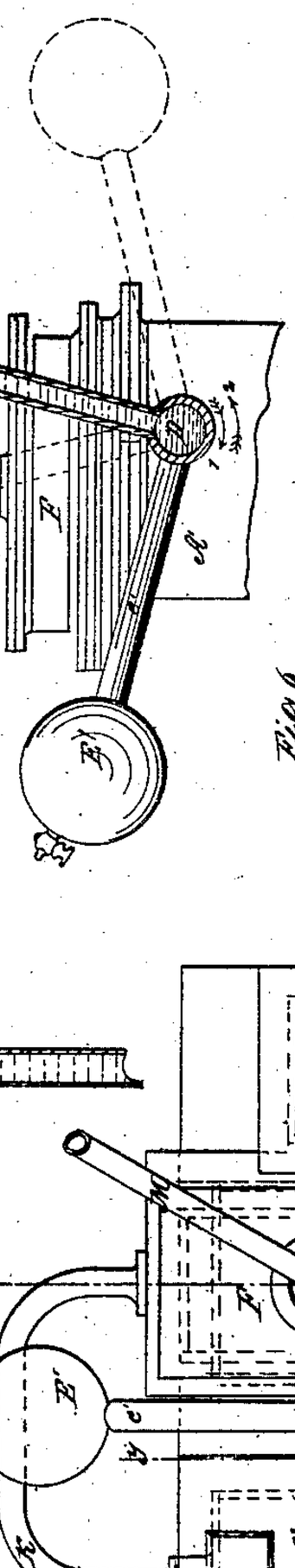

Fig. 5

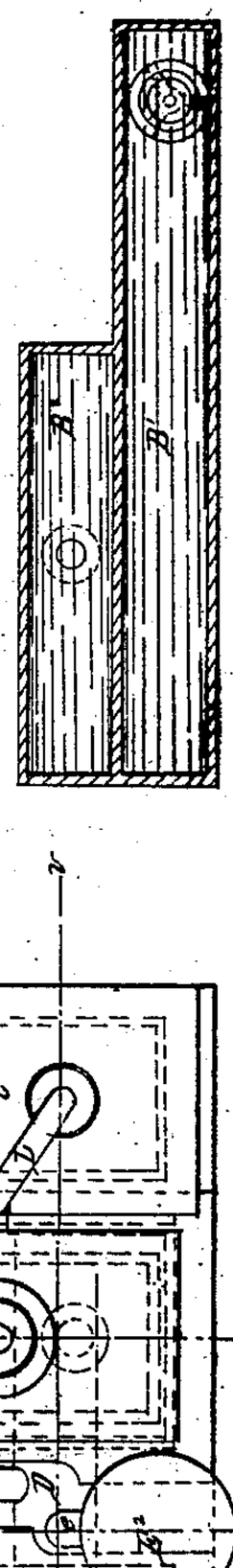

Fig. 6

Fig. 2

Fig. 1

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Sheet 2 - 2 Sheets.

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Fig. 8

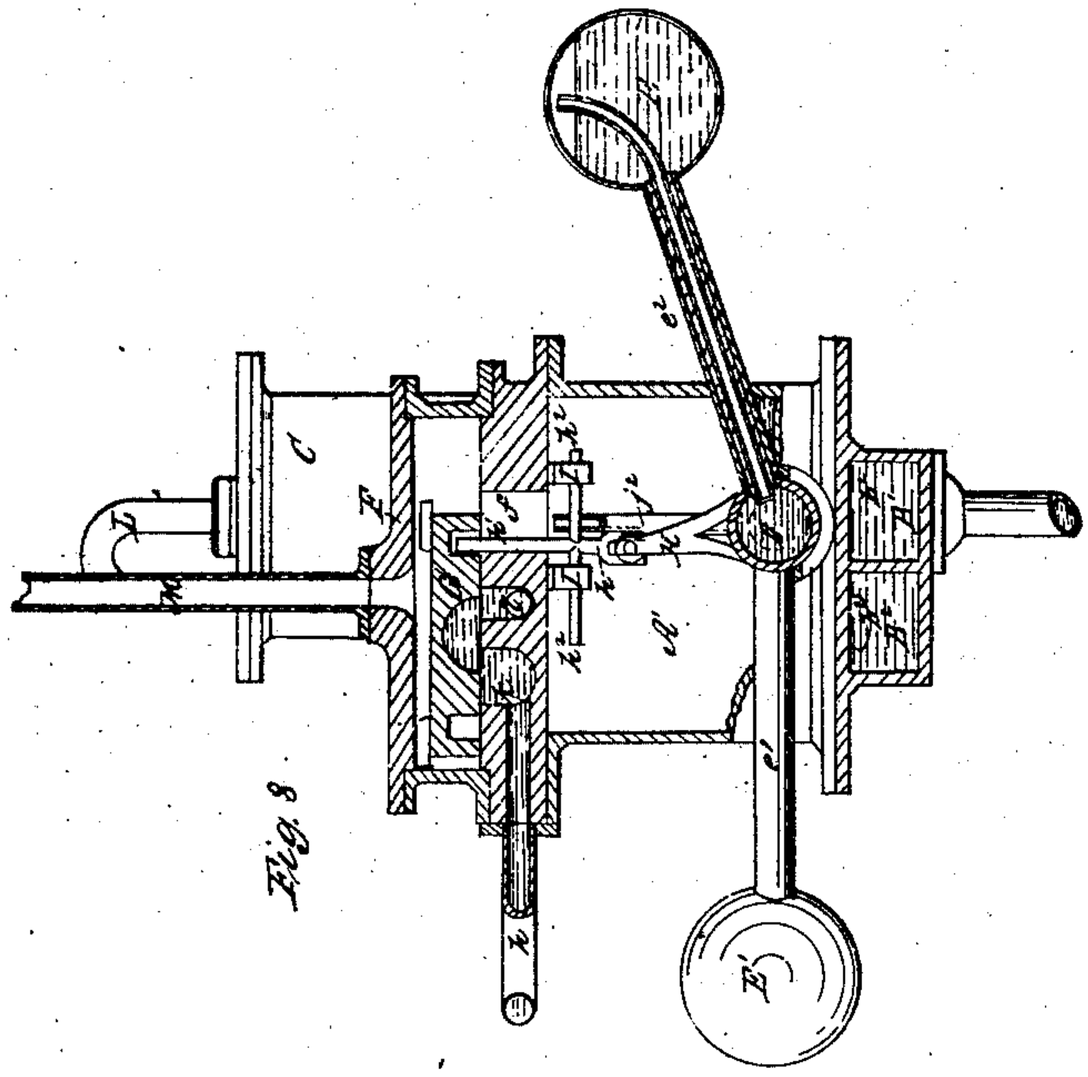


Fig. 10

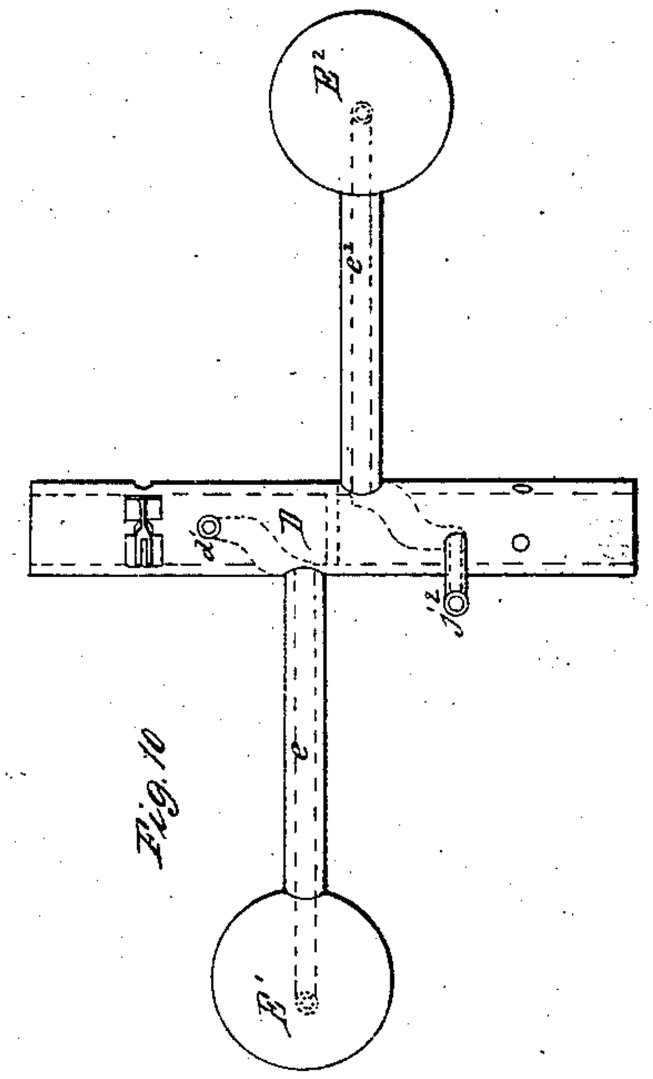


Fig. 7

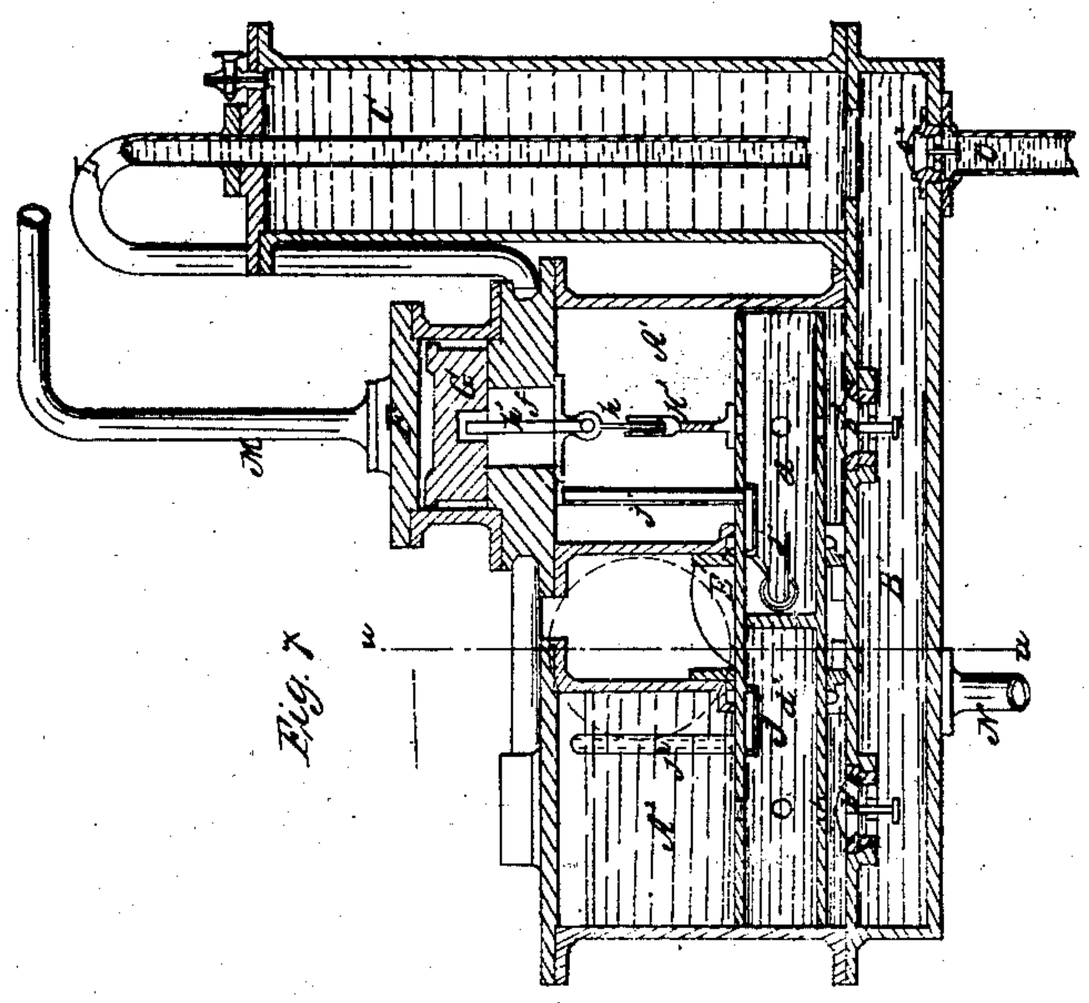
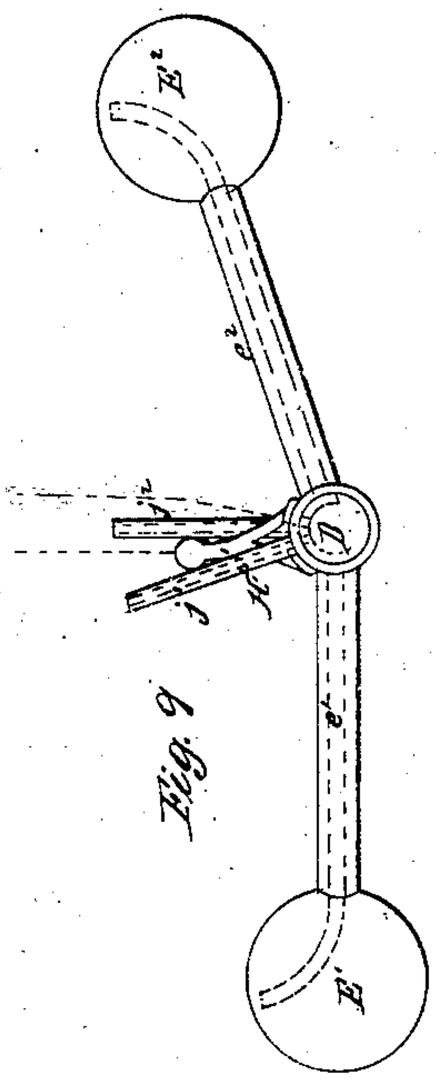


Fig. 9



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THE ECKERT LITHOGRAPHING CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORGE I. WASHBURN, OF WORCESTER, MASSACHUSETTS.

IMPROVED BOILER-FEEDER.

Specification forming part of Letters Patent No. **41,408**, dated January 26, 1864.

To all whom it may concern

Be it known that I, GEORGE I. WASHBURN, of the city and county of Worcester and State of Massachusetts, have invented a new and Improved Automatic Apparatus for Elevating Water and Supplying Steam-Boilers; and I do hereby declare the following to be a full and exact description of the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of the said apparatus. Fig. 2 is a vertical longitudinal section of the same at *v v*, Fig. 1. Fig. 3 is a transverse section at *w w*, Figs. 1 and 2. Fig. 4 is a transverse section at *x x*. Fig. 5 is a vertical transverse section of a portion of the apparatus at *y y*. Fig. 6 is a horizontal section at *z z*, Figs. 2, 3, and 4. Fig. 7 is a section in the same plane as Fig. 2, illustrating a modified arrangement of some of the parts. Fig. 8 is a vertical transverse section at *u u*, Fig. 7. Fig. 9 is a transverse section of the rock-shaft representing the oscillating hollow arms in elevation. Fig. 10 is a plan or top view of the said shaft and arms.

Similar letters of reference indicate corresponding parts in the several views.

The principal object of my present invention is to produce an automatic apparatus which will elevate water with economy and rapidity; and this I accomplish by the instantaneous condensation of steam under any pressure within closed chambers.

The apparatus which may be used in carrying out my invention, and which I shall proceed to describe as illustrative of the same, consists, essentially, of two or more closed chambers, each of which is thrown alternately into communication with the boiler and with a condensing-chamber, to which the supply-pipe has constant access through a port which may, if preferred, be provided with a check-valve to prevent any reflux of water which might occur immediately before or at the instant of condensation. The opening and closing of the ports to place the respective chambers alternately in communication with the boiler and the condensing-chamber may be effected by a suitable valve operated automatically by the weight of water within spheres mounted upon arms projecting from a rock-shaft, all of which are made hollow and communicate with the first-named chambers in manner hereinafter described.

A′ A² represent a pair of steam-tight chambers extending transversely across two troughs or chambers, B′ B², of unequal length, each of which communicates with both the said chambers through ports guarded by valves *b′ b′ b² b²*, the valves *b′* in the channel B′ opening upward, and the valves *b²* in the channel B² downward. The long channel B′, I denominate the "cold-water trough," and the short channel B² the "hot-water trough."

C represents a third chamber rising from the rear end of the cold-water trough B′, with which it is in free communication. The last-named constitutes the condensing-chamber, and may extend to a height double that of the chambers A′ A².

D is a hollow shaft, fitted to turn within steam-tight joints in the adjacent walls of the chambers A′ A². The interior of this shaft is divided by a partition, *d*, so that one end, *d′*, may open into the chamber A′, and the other end, *d²*, into the chamber A², while no communication exists between them.

E′ E² are hollow spheres attached to the ends of hollow arms *e′ e²*, which communicate with the interior of the shaft D on opposite sides of its partition *d*.

F represents a valve-chest inclosing a slide-valve, G, which is formed with projections *g g*, fitting within the valve-chest F, to guide the valve in proper position. The seat F′ of the valve F is provided with three ports, *f*, *k*, and *l*. The valve is moved by the oscillation of the shaft D by means of a cross, H, formed with a short arm, *h*, fitting loosely in an aperture in the shaft D, a long arm, *h′*, projecting upward through the steam-port *f* into an aperture in the valve G, and horizontal arms *h² h²*, working in guides I I. (See Fig. 4.) In Figs. 7 and 8 the shaft D is represented as placed in the lower part of the chambers A′ A². This affords room for the introduction of small pipes *j′ j²*, extending within the shaft D, and arms *e′ e²*, from the upper parts of the respective balls E′ E² to the upper parts of the chambers A′ A², for the purpose of conducting steam to the interior of the balls when the latter are emptied of water, as hereinafter explained.

The arms *e′ e²* may be set at a greater angle

apart or approaching more nearly to horizontal positions, as shown in Figs. 8 and 9, so that the weight of water within the balls will be more effective in oscillating the shaft.

A smaller oscillation of the shaft may then be made to move the valve to the required extent by the use of a rigid arm, H′, attached to and projecting upward from the shaft and engaging in the forked end of the arm *h*, as shown in Fig. 8; or the said arm *h* may be elongated to reach the shaft, or an intermediate lever introduced and the width of the ports in the valve-seat reduced to any required extent.

The valve-chest communicates through the port *f* with the interior of the chamber A′, through the port *k* and pipe K with the interior of the chamber A², and through the port *l* and pipe L with the condensing-chamber C. The said pipe L is of arched or siphon form, rising to some height above the top of the chamber A′ and extending down within the condensing-chamber to near its bottom, as shown in Fig. 2, so as to deliver steam in the lower part.

M is a steam-pipe leading from the steam-space of the boiler to the interior of the valve-chest.

N is a pipe communicating from the water-space of the boiler to the hot-water trough B².

O is a water-supply pipe taking water from any suitable reservoir not more than thirty-two feet below and delivering it through a port guarded by a valve, *o*, opening upward into the cold-water trough B′, directly beneath the condensing-chamber C.

Operation: Steam is first blown through the apparatus to expel the air, and it is then permitted to condense by external radiation in all parts of the apparatus, excepting those which are in communication with the boiler. The various parts being placed in the positions shown, the vacuum produced by condensation within the chambers A² and C and ball E² will cause them to be filled with water forced by atmospheric pressure up through the pipe O, any water which may have been in the chamber A′ descending through the port *b*², Fig. 4, into the boiler until the water finds its level in the boiler and in the said chamber, which, together with the ball E′, is now in communication with the steam-space. This period of the operation is shown in Figs. 2, 3, 4, and 5 of the drawings. The weight of water within the ball E² will now overbalance the empty ball E′, and turn the shaft D in the direction indicated by arrow 1 in Fig. 5, which throws the valve G to the other extremity of its stroke, placing the chamber A′ in communication with the condensing-chamber C and the chamber A² in communication with the valve-chest and the steam-space of the boiler. The water in the chamber B² will then flow down into the boiler until it finds its level. At the same time an equilibrium of pressure is established between the chambers B′ and C, when the water within the chamber C will descend by its gravity and fill the chamber B′ and ball E², the steam which the chamber and ball contained passing through the pipes *j*′ and L, and being delivered beneath the water within the condensing-chamber C, by which means it is instantaneously condensed without previous expansion or reduction of pressure. The vacuum thus formed causes a new supply of water to be forced up through the pipe O by atmospheric pressure, until the chambers A′ and C and ball E′ are completely filled with water, which, by turning the shaft D in the direction of arrow 2, causes the position of the valve G to be again reversed, emptying the chamber B′ into the boiler, condensing the steam within the chamber B², and refilling the latter with fresh water, when the work proceeds as before.

The invention is applicable to the purposes of a steam engine condenser and boiler-feeder, as above described, or may be used for elevating water for other purposes in any place where steam is available to work it.

As condensation and the consequent removal of atmospheric pressure is alone depended on for power, the apparatus may be operated without cost by connecting it with the exhaust-port of any non-condensing engine, so as to employ waste steam either with or without a pressure in excess of that of the atmosphere.

The check-valve *o* is useful in preventing any reflux of water before the steam can be condensed. It also admits of the condensation of high-pressure steam, without previous expansion, and within a smaller chamber than would otherwise be practicable without loss of power. Whatever the pressure of steam introduced, any reflux of water will be prevented by the instantaneous closure of the check-valve, and the steam thus confined will be condensed by being driven into the body of water in the condenser by the gravity of the said water, as before explained.

I do not desire to be understood as limiting myself to any particular form of the valve G, or of the devices for operating it, but propose to vary the same in any manner which may be found desirable consistently with the essential principles upon which the apparatus works.

A single slide-valve of large size, operated by means analogous to those described for operating the valve G, may be substituted for the four check-valves between the chambers A′ A² and channels B′ B². The said slide-valve will work within a hot-water chest communicating with the steam-space of the boiler and over three ports, the center one communicating with the condensing-chamber C, and the end ports with the respective chambers A′ and A². This valve will be worked simultaneously with the valve G, so that when the upper part of either chamber is placed in communication with the valve-chest F, (and consequently with the steam-space of the boiler,) the lower part of the same chamber will be in communication with the water-space of

the boiler, and when the upper part of either chamber is placed in communication with the pipe L, which leads into the condensing-chamber C, the lower part of the same chamber will communicate with the lower part of the condensing-chamber.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. Condensing a body of steam within an apparatus having no external outlet, by forcing it from one chamber to another by the gravity of water and causing it to pass beneath the surface of, and in contact with, the water in the chamber into which it is forced, substantially as herein described.

2. In a condensing or pumping apparatus, operating substantially on the principle specified, the use of a check-valve *o*, operating as described, to prevent the reflux of water into or down the supply-pipe.

3. The combination of the hollow divided shaft D, chambers A′ A² E′ E², and valve G, operating substantially as and for the purpose set forth.

4. The combination of the rod H with the oscillating shaft D and valve G for imparting motion to the said valve, as explained.

5. The chambers A′, A², and C, and troughs B′ B², operating together in manner substantially as and for the purposes set forth.

The above specification of my improved apparatus for elevating water and supplying steam-boilers, signed this 24th day of September, 1863.

GEO. I. WASHBURN.

Witnesses:
JAMES H. GRIDLEY,
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